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Personnel

INFORMATION FOR DESIGNERS OF INSTRUCTIONAL SYSTEMS ISD AUTOMATED TOOLS/WHAT WORKS

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This volume provides information and guidance for applying current instructional technology and the Instructional System Development (ISD) process described in AFMAN 36-2234. This volume may be useful to all Air Force personnel who plan, develop, approve, administer, or manage Air Force instructional programs. The use of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

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Chapter 1
GENERAL INFORMATION

Overview

Introduction

For many years, the military services have developed and applied instructional technology. In this evolutionary process, we need to continually learn better ways of instruction.

Mission objective

One objective of the Air Force is training personnel to meet mission requirements. Therefore, to help fulfill that objective, we must:

- Apply the best methods in all phases of education and training.
- Continuously evaluate those methods to ensure quality is totally integrated.

Education and training efficiency and effectiveness result when quality is integrated.

Source

In 1988, the Department of the Navy, in an attempt to improve their Education and Background Training Program, ventured out to see what educational techniques and automated tools were being used in the civilian classroom.

The result of their effort was the publishing of "What Works - A Summary of Research Findings with Implications for Navy Instruction and Learning" (Montague, 1988). The Navy allowed us to borrow their publication findings in order for us to create our own volume.

Purpose

Many of you will find what is suggested in this volume to be common sense. However, common sense is not necessarily common practice. The information contained in this volume has four purposes:

- It serves as a reminder and guide to implement improvements within the constraints of current education and training situations.
- It provides information to assist with the long-term planning for education and training improvement.

Continued on next page

Purpose (Continued)	- It provides the Education and Training Manager, Instructor and Specialist with a myriad of techniques proven effective to improve the quality of instructional programs. - It provides several automated tools currently in the Air Force Inventory that could enhance the classroom learning experience.
Limitations	We know these techniques and automated tools are not inclusive. You may not be able to apply some of these techniques and tools in all of the Air Force Education and Training centers of learning.
Goal	Our goal is to provide a forum to exchange classroom-proven practices, which will increase knowledge and skill retention, yielding greater job proficiency as well as mission readiness.
Revisions	Please send us your proven techniques and tools so we may incorporate them in future revisions.

Chapter 2
EDUCATION and TRAINING TECHNIQUES

Overview

Introduction

Education and Training involves a diversity of personnel working in various capacities, as the previous matrix points out. This section will look at the instructional techniques that relate to all education and training personnel; however, for ease in reference, three major categories are used: instructional managers, instructors, and specialists.

Where to read about it

This chapter contains three sections.

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Section A
Techniques for Instructional Managers

Where to read about it

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	Effective Schools
Important finding	Effective schools focus sharply on students and learning.
Effective instruction	Instructional managers and instructors can increase instructional quality by implementing policies that encourage effective instruction as: - They emphasize frequent testing, testing of job-like performance, critical job skills, and safety practices. - They encourage effective time management to reduce or eliminate time spent on activities irrelevant to training objectives. - They maximize interaction between students and instructors, learning materials and learning tasks.
Students	Students must be psychologically and physically comfortable. Long lectures requiring prolonged periods of sitting without opportunities for practice inhibit effective learning.
Managers	Managers must work with instructors, students, and the operational community to develop and establish a positive learning environment that will become a lasting part of the school's tradition.
Instructors	Instructors must collaborate in developing goals, sharing advice about teaching, and emphasizing student achievement, instruction as well as students' performance improves.

Managing Instructors

Important finding

Effective instructional management policies improve instructors' training, student performance, and time management.

Effective managers

With instructional improvement as a constant theme, effective managers should:

- Scrutinize existing practices to ensure instructor training contributes to the quality of instructional programs.
- Provide instructors with the opportunity to improve their instructional and classroom management techniques.
- Develop policies to support instructor requirements by encouraging new ideas.
- Ensure the availability of instructional materials and assistance instructors need.
- Work to raise instructor morale and create a climate of achievement.
- Allow instructors to participate in policy formation processes.

Evaluating and Supervising Instructors

Managers

Managers enhance instructors' teaching skills by:

- Making frequent and systematic classroom observations.
- Providing relevant, timely feedback that includes suggestions for correcting weaknesses and praise strengths.
- Ensuring instructors know the subject matter and can teach it well.
- Providing new instructors opportunities to practice under supervised conditions.

Supervision

Supervision that strengthens instruction has the following elements:

- The supervisor and instructor agree with specific skills and practices that characterize effective teaching.
- The supervisor observes the instructor frequently to verify use of these skills and practices.
- The supervisor and instructor discuss supervisory observations.
- The supervisor and instructor agree on areas for improvement.
- The supervisor and instructor jointly develop specific improvement plans.

Student ratings

Managers can use student ratings of instructors to improve the overall instructional processes as:

- Ratings may provide useful, constructive feedback.
- Ratings during a course, rather than only at the end, provide the opportunity to modify teaching with the same groups of students.
- Fellow instructors or education/training specialists can help individual instructors plan how to improve their teaching based on student feedback.

Managing Students

Important finding	Performance-oriented leadership improves formal (intentional) and informal (incidental) learning.
Manage learning	To manage learning effectively both inside and outside of the classroom, managers should: - Ensure that formal learning is developed with systematic procedures. - Stress the importance of each student's learning. - Specify the roles of all personnel in managing learning. - Personally evaluate the learning environment i.e., who is doing what, when, where, why, and how? How does the physical learning environment affect learning? What is happening in the school that should not be happening?
Outside learning	Students learn a lot outside of formal education and training. For example, some students adopt behaviors from instructors during instruction; others acquire skills from peers.

Monitoring and Tailoring

Important finding	Instruction improves when managers monitor achievement indicators, detect when the value of any indicator moves into an unacceptable range, and then take focused, corrective action (tailoring).
Controlling instruction	Monitoring and tailoring instructional systems are similar to controlling physical systems such as heating or cooling systems. However, education and training system indicators are not as apparent as physical system indicators.
System indicators	Education and training system indicators are determined by: - Examining the goals and management practices of the school. - Obtaining objective information about students and instructors.
Monitoring	Monitoring focuses on improvement in instructional quality. Training managers can monitor direct and indirect student performances to establish priorities for improving the system: - Monitoring requires access to effective record keeping and considerable information processing. - Monitoring with a computer-based information system, managers can identify student indicators with values that are in an unacceptable range. - Monitoring will reveal whether the quality of instruction is being improved.
Monitoring indicators	Training managers can monitor direct and indirect student performances to establish priorities for improving the system. The following indicators are helpful in the monitoring process: - Direct indicators include student attrition, and comprehensive and performance test scores. - Indirect indicators include student-instructor ratios and background variables.

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Tailoring	Focused corrective action or tailoring requires a deployable resource to respond to the indicators. For example, an instructional supervisor or curriculum standards office representative might visit a classroom or school to confirm (or refute) that a problem exists, diagnose the situation, and propose corrective action.
Conclusion	The monitoring and tailoring approach assumes that fine tuning the instructional system can improve the system significantly. The system may require fundamental changes due to changes in technology, resources, or society.

Evaluation and Revision

Important finding	Tryouts during instructional development help identify and correct inadequacies.
Student tryouts	Evaluating and revising instruction are important processes. The developer accomplishes this by taking segments of material to a sample of students for tryout. This developer goes through the material with each student. During tryouts, students might be asked about: - The quantity and quality of examples in the instruction. - The adequacy of practice opportunities. - The suitability of media selected for a given education and training domain. - The compatibility of the reading grade level of the materials and the student audience. - The time required for the student to complete the instruction compared to the allotted training time.
Revision	The developer then revises the materials to address problems uncovered in tryout and conducts another tryout with different students.
Summary	Instructional development rarely includes this evaluation-revision cycle. Tryout of the materials in nearly final form is more common. At this late stage, it is difficult to diagnose instructional problems unless a gross failure makes them apparent.
Conclusion	The lack of evaluation during development makes revision of instruction a major undertaking. Looking at the ISD process as continuous evaluation will help resolve this dilemma.
Lesson learned	The lesson learned is that managers who plan and allocate adequate resources for early evaluation make the revision process and instruction more effective.

Imitating the Job Environment

Important finding	Students learn and retain knowledge and skills best when the learning environment incorporates the critical, functional features of the working environment.
Job transfer	For maximum transfer from the education and training environment to a work environment: - The learning environment should include the context, tasks, procedures, and materials of the job. - Education and training should relate to the specific job environment, as well as the knowledge the student already has. - Training should involve the same operations, tools, and machines (or their functional equivalents) as the actual job.
New built on old	New knowledge is built on the foundation of old knowledge. Facilitating learning requires that the training relates to the students' existing knowledge. Students can use existing knowledge to facilitate learning and correct any misunderstandings of how and why things work the way they do. This will help bridge the gap on what new knowledge needs to be taught.
Job performance	Another important aspect of imitating the job environment is training students to the level of the job performance requirements. If the job requires much supervision, then students should not be trained to a high level--one that does not require supervision. Effective education and training managers should solicit graduate feedback to detect inconsistencies between training levels and job performance requirements.
Tailor to assignment	Minimal on-the-job supervision requires higher levels of training. If training and working environments differ in their skill expectations and closeness of supervision, instruction should be tailored for the expected assignment.

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Solicit feedback	Effective education and training managers should solicit feedback about graduates to detect problems in mismatches between levels of training and expectancies.

Maintaining Skills and Knowledge

Important finding

Maintaining critical skills requires planned and monitored on-the-job training and testing.

Skill loss

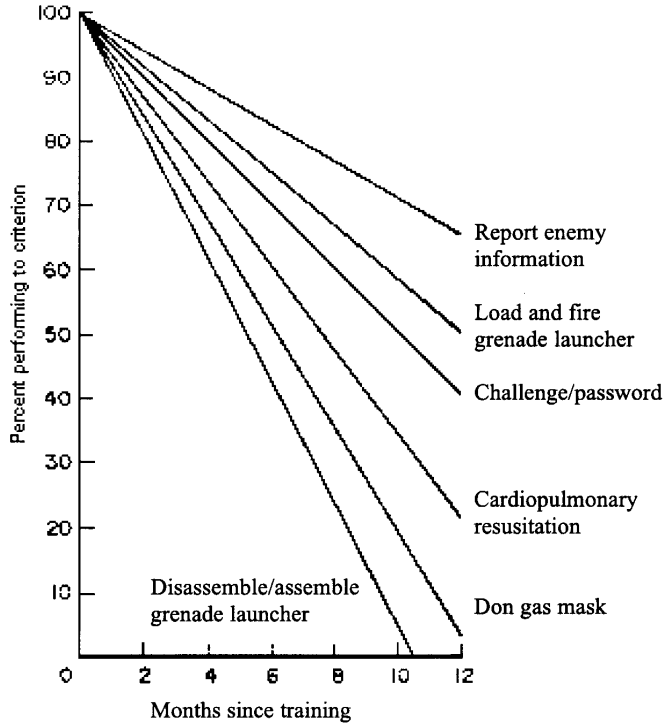
Points about skill loss:

- Performance of some procedural skills declines rapidly without systematic refresher training.
- The rate of skill loss differs for different tasks. The decline suggests the need for systematic practice to maintain skills.

Example of skill loss

Figure 1, taken from Hagman and Rose (1983), shows the decline in the number of soldiers able to perform basic soldiering tasks after training. Rate of skill loss differs for different tasks. The decline suggests the need for systematic practice to maintain skills.

Figure 1. Rate of Skill Loss.



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Preventing skill loss	Normally, schools provide sufficient training for initial job competency. Proficiency is normally developed on-the-job. The following applies to maintaining proficiency: - On-the-job practice of rarely used skills is often lacking. - Long lapses in training promote losses not improvement of skills and knowledge. - Initial training must include the maximum amount of practice possible. - Retraining must be provided at intervals.
Estimating skill loss	There is no way to make accurate, quantitative predictions about the rate of skill loss, how fast relearning occurs, or how often retraining should occur.
Refresher training	The bottom line is that planning and scheduling refresher training is essential. - Base the spacing of refresher practice sessions for novices on how often trainees perform the skill or task. - More than minimal learning should be provided during the original course when refresher training is difficult or too costly to arrange.

Student and Instructor Ratios

Important finding	Enlarging class size in most large basic courses has little effect on student learning. It frees instructors for lab training, tutoring, or counseling.
Class size	Class size has the following relationships to learning: - Small student-instructor ratios tend to promote frequent interactions between students, instructors, and materials. - Students in small classes achieve more; they also have more interest in learning. - When class size exceeds 12 students, fewer opportunities for class participation exist. - In lecture presentations, class size does not make any difference because interactions are minimal, even in the informal lecture arena. - Class size in basic courses, unless it's below 10 students, does not affect student learning. If the class gets so large the student can neither see nor hear the instruction, this will become detrimental to learning.
Ratio management	Managers should occasionally change instructor and student ratios to maximize instructors and improve student learning. Merging classes to relieve some instructors can provide additional time for them to perform other instructional functions.

Managing Informal Learning

Important finding	Aggressive management of learning can improve the incidence and quality of informal learning.
Informal learning	Students obtain much of their knowledge and skills outside of formal training: - Managers can positively influence informal learning by placing instructional information in areas where students frequent (dormitories, cafeterias, etc.). - Instructional information should be designed not only to foster learning, but also to create awareness and motivation. - Instructional requirements can be promoted by placing instructional materials at job sites, requiring reading of job, and education and training materials during slack time. - Students should be encouraged to set aside "read and think" time during duty hours. This will help them to think about what they do, and how to do it better.

Planning for Change

Important finding	Exploiting communications and computer technologies can serve policy goals and meet education and training needs within resource constraints.
Capturing technology	Many recent advances in communications and computer technologies can be used for instructional purposes. New technology may enable the delivery of conventional forms of instruction in new ways.
Effective use of technology	Various technologies can be used to develop and deliver instruction that can be as effective, or more effective than current methods. To capture technological benefits, you must: - Conduct good planning and analysis. - Compare cost effectiveness benefits with needs and the current costs of training. - Identify funding for evaluation of new systems designed to make instruction more effective.
Cost versus impact	The rapid development of new technologies points to the inevitability of significant changes in the way education and training is developed and delivered. - Potential costs of these changes require caution and a practical outlook. - Claims of large benefits in effectiveness must be substantiated by concrete, conclusive empirical evidence. - Decades of research reveal that improvements in instructional achievement are usually not due to the communications and computer technology but to redesign of the content. - Permitting each student to learn at his/her own pace, with or without technology, is an important source of the gain.
Planning for change	Planners should research the suitability of Commercial-Off-The-Shelf (COTS) products for courseware development and computer-based delivery of instruction. Determine whether software and systems have already been developed, by industry or internally, that can meet your training needs.

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Caution on big applications	Large-scale implementation of education and training technologies that substantially change the organization and presentation of instruction should be undertaken only after formal study of its cost effectiveness.
Other references	The following paragraphs will present some of the technologies the training manager can use to select appropriate media, and to develop courseware. Chapter 3 will review some of the latest tools, such as Designer's Edge.

Cost Effectiveness

Important finding	Consistent and credible evaluations of cost-effectiveness must justify any plans to substitute alternative education and training programs for those now in use.
Low cost	Declining costs of computer-based and communications technologies makes their use in the delivery of instruction a smart move.
Must make a difference	Introducing new technology must make a difference and not add to increases in the already high cost of education and training.
Must show benefits	To offset or justify the cost of technology, these benefits should be demonstrable: - Instructor productivity or the number of students graduated in a time period should increase. - Student performance should improve substantially. - Administrative burdens over the life of the system should be reduced.
Good planning	Changes require good management planning as well as changes in the instructional program.
Cost of alternatives	The decision to implement a particular instructional program, course or device, or to change to an existing one, rests upon identifying the costs of all the alternatives, such as: - The cost of research and development. - All personnel costs in development. - Development and delivery costs of all versions of equipment. - The cost of running the implementation for the life of the system including operation and maintenance.

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Summary	When the conventional instructional system and a technology-enhanced system demonstrate the same effectiveness, the one that costs the less might be preferred.

Conclusion	Substantial demonstrated differences in instructional effectiveness must be considered before applying alternative programs, courses, or devices.

Structuring and Sequencing Instruction

Important finding	Students learn as well from structured materials and self-study as from conventional classroom procedures. It works as well as conventional methods for teaching knowledge.
How to structure	Structuring materials require you to do as follows: - Divide instructional materials into learnable segments. - Determine their presentation order. - Require students to pass tests to demonstrate comprehension before allowing them to progress to new instruction.
Structuring advantages	Structured instructional materials provide: - Students an opportunity for self-paced study. - Considerable saving of training time. - Distribution to remote locations as alternatives to lectures.
Sequencing	Instructional sequencing is designed to require an active response from students before new information is presented.
Sequencing advantages	Some of the advantages of sequencing to consider: - Students get immediate feedback. - Students may omit material they already know. - Students may identify segments where errors require further study. - Students may receive instruction on various media such as computers, workbooks, or lectures.
Structuring examples	Many Computer-Aided Instruction (CAI) programs are examples of structuring instruction; others use simulation or gaming techniques.

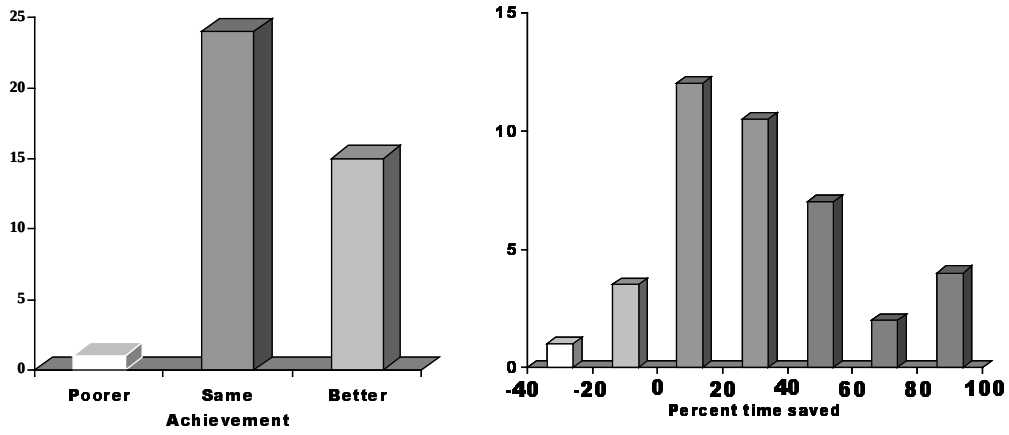
Self Paced Instruction

Important finding	Students who progress through the materials at their own rate complete the materials in about one-third less time than do students who attend conventional courses.
Student attitudes	Student preferences and attitudes in comparing self-paced with conventional instruction: - Students prefer having an instructor present the instruction. - Students prefer sitting in a classroom with a human being who can listen and respond rather than sitting in a media carrel. - Students have similar attitudes toward the content in group or self-paced.

Interactive Courseware

Important finding	Students learn the same content as well or better from Interactive Courseware (ICW) as in the regular classroom.
ICW advantages	Advantages of computer-based instruction are: - Students complete lessons faster. - Course materials can be widely distributed and given at any time.
Research on ICW effectiveness	Figure 2, taken from Orlansky and String (1979), provides a graphic summary of a review of 40 research studies comparing the effectiveness of interactive courseware and standard training in the Air Force, Army, and Navy.

Figure 2. Effectiveness of Interactive Courseware.



ICW research summary	The summarized results are as follows: - Fifteen studies reported higher achievement for ICW students. - Twenty-four studies reported no difference between student achievement in either form of instruction. - One study reported lower achievement for ICW students. - These studies indicate that students complete their lessons in 30 percent less time with ICW.
Verified suitability	These findings are important where students are paid and training time needs to be as brief as possible. The evidence from the 40 research studies verifies the suitability of interactive courseware in the military.
ICW compared	A review of nearly 200 studies comparing ICW with conventional elementary, secondary, and college instruction found: - ICW raised student achievement significantly. - ICW students gained a better appreciation of technology. - ICW led to improvement in student attitudes toward schools and teaching. - ICW helped teachers manage instructional time.
Reasons for ICW effectiveness	Effectiveness and efficiency gains do not result simply from using interactive courseware in the instruction. They result from applying a systems approach to the course design and allowing students to progress at their own learning rates. Military courses normally require instructional systems development for all courses and so the gains from ICW would be primarily from timesavings and not improved student performance.
Careful planning required	Careful planning is necessary before deciding to use ICW. In each situation, cost-effectiveness is a critical issue. True ICW is an excellent method of instruction but in some cases time and resources are not available to develop a course using these media.

Video Technologies

Important finding	Video technologies can simulate world events, equipment, or tasks and deliver interactive instruction in formal schools and remote worksites, referred to as Interactive Video Disk Instruction (IVD).
Telecommunications advantages	Telecommunications technologies have the potential for delivering instruction to learners at formal schools and remote sites. Advantages are: - Blends of technologies can provide learning experiences, which emphasize interaction and individualized learning. - Linked video and computer technologies can provide interactive training incorporating such important variables as immediate feedback, individualized pacing, and almost unlimited combinations of text, audio, graphics, and full- motion video. - Multiple branching, immediate feedback, and individualized interaction are other inherent features.
IVD advantages	IVD can enhance the effectiveness of computer-based instruction. IVD advantages are: - Full motion video better supports learning objectives requiring observation of people or machines in motion. - Students completing IVD score considerably higher than students in traditional courses. - Students in self-paced IVD learn the same or more in less time than in lecture-based presentations.
Needs assessment	IVD requires needs assessment and cost-effectiveness analyses be performed before implementation.

Simulators

Important finding	Simulators enable learners to acquire the knowledge they need to operate and repair devices. Learners can practice at speeds not constrained by real time at a fraction of training cost over using actual equipment. Simulators also decrease the risk of personal harm or damage to actual equipment.
Simulator definition	Simulators may be devices that physically resemble actual equipment (a mock-up or part-task trainer) or a type of computer-based training (CBT) in which computer images or video are used to represent the equipment.
Simulator advantages	Simulators offer many training advantages: - They are cheaper to practice on than actual equipment. - They are often easier to understand than the actual equipment because they can depict normally invisible functions and events such as electron flows. - They can determine how much practice the student needs and can isolate and repeat the difficult segments of a task. - They can present events at speeds that are much faster than real time. - They present the effect of manipulations so they can be seen quickly. - They provide the opportunity to accomplish additional practice quickly. - They can incorporate important training variables such as detailed performance evaluation and feedback.

Development and Use of Simulators

Important finding	Design, development, and use of simulators require careful planning and special skills.
Design development factors	The following factors are important to the design and development of simulation devices: - Design decisions must be related to the cognitive processes required to learn the task rather than focusing on particular hardware or the medium. - An effective simulator should isolate relevant cues while students learn to ignore irrelevant information. - A simulator's effectiveness is more a function of the instructional methods used to support learning. - A simulator's physical similarity to the device it represents does not determine its effectiveness. - Tryouts with typical students are important to validate the design.
Analysis required	Remember that needs assessment and cost-effectiveness analyses must be accomplished before acquiring this medium!

Distributed Learning and Tele-training

Important finding	Students away from formal schools can interact with instructors through modern communications technology such as networked computers with or without television.
Electronic network advantages	Through instructional electronics networks, students alone or in small groups, can learn skills and knowledge where they will use them: - Telephone computer networks control audio or electronic exchanges between students and instructors. Satellite links, cable television, or cassettes deliver video if needed. - Participants work on problems particular to their own situation when their work schedule allows. - Variations are possible. Participants can delay the interactions by saving questions, answers and comments until time is available to address them.
Tele-Training advantages	Teletraining involving one-way video with two-way audio links is perhaps the best compromise between cost and information quality. The advantages are: - This provides full presentation of visual information and allows students to ask questions or make comments at any time. - Compressed two-way video is also becoming more economically feasible. - The advent of large-scale digital networks and satellite links has made video teleconferencing more commonplace.
Tele-Training deterrents	Deterrents to the use of teletraining are the significant preparation time, equipment costs, and relatively complex logistics required.

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Benefits of teletraining

The following are benefits of teletraining:

- Enables new students to observe experienced specialists.
- Reaches learners where and when the training is needed.
- Shifts more responsibility for acquiring the skill from the trainer to the student.
- Saves travel cost by not requiring time away from job.

Micro-Computer advantage

Microcomputers can also serve as terminals to remote data banks and network members. Through telephone connections and a centralized message workspace, learners can ask questions or propose solutions to other members sharing the network. This provides an inexpensive source for high quality ICW lessons, desktop simulators or simulations.

Adopting Change

Important finding	Education and training managers and developers can affect the rate at which the schools and instructors adopt newly developed instructional materials and programs.
Adopting strategies	Points on adopting strategies: - Training commands and schools should consider the strategies used to encourage the potential users to adopt the new materials. - One way of overcoming the "not invented here" attitude is to involve all potential users in the analysis and design phases of innovative courses.

Managing Change

Important finding	Using an effective person as an agent to manage change is a critical factor in its spread.
Role of change agent	The agent studies the potential adopting organization and systematically shows that the innovation: - Has obvious advantages over the existing process, materials, or equipment. - Is compatible with the existing system. - Is supported by significant research and/or evaluations. - Is a rational sequence for its adoption and application. - Addresses an identified need of the potential user. - Will be used for a long time. - Can be adopted by the staff with minimum training.
Managing change	To properly manage change, the manager must concentrate on the following related to: - The potential users and their needs rather than the material or the innovation. - The situation as well as the potential user. - The need to tailor the innovation to the user's needs. - The need to explain the innovation to the potential users.

Conclusion to Techniques for Instructional Managers

Manager should accomplish

After reviewing this Section, regarding important techniques for the instructional manager, you should now be able to accomplish the following:

- Become an assertive instructional leader by putting instructional excellence first.
- Focus programs on instructional goals and protect them from irrelevant demands.
- Demand high quality training from staff, instructors, and students.
- Develop and monitor in-service staff training.
- Encourage consensus on values and goals.
- Establish a system for evaluation and monitor it systematically.
- Bring instructional technology and good practices to bear on instruction.
- Promote a positive climate and overall atmosphere.
- Plan and coordinate long-range changes in education/training to increase effectiveness and efficiency.
- Analyze and plan for use of technology to increase productivity.
- Consult with education and training specialists about respective policy and practices.

Instructor role

In the next section we will turn our attention to the most influential person in the eyes of the student, the instructor.

Section B
Techniques for Instructors

Where to read about it

The following topical index is provided as a quick reference to this section.

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	Student Feedback
Important finding	Instructors can improve their performance through careful analysis of student feedback.
Benefits of student ratings	When schools require students to rate instructors, they expect instructors to use the ratings for improving instructional techniques. Evaluation studies show that feedback from student ratings improves instructor performance: - Research on college teaching revealed that instructors who received feedback from mid-semester ratings received substantially higher end-of-course ratings than instructors who were rated at the end of the semester did. - Ratings improve more when instructors discuss the mid- semester with consultants or received help in reacting to them. - Instructors and managers can use ratings during a course to modify and improve teaching with the same groups.
Feedback timing	As with all feedback, it is timing and content which influence its effectiveness. Other instructors or education and training specialists can help individual instructors improve their teaching through student feedback.

Student Activities

Important finding	Student activities during learning are more important in determining what is learned than the instructor's presentation.
Planning active learning	Instructors aid student achievement by getting students to engage in activities that are likely to result in learning: - Effective instructors not only present facts, ideas, or information but also get students actively involved in appropriate learning activities to attain desired outcomes. - Learning is an active process, and instructors should develop as many learning strategies as possible to help students achieve the objectives.
Prior knowledge	During the learning processes, instructors should consider students' prior knowledge. Students' understanding of new information depends on how well they relate it to their prior knowledge: - Students often begin learning with substantial misconceptions about the material they are studying and its intended use. - Even students who get high grades have these misconceptions. - Students make systematic errors based on misconceptions and erroneous procedures from prior knowledge.
Instructional intent	Students should never begin instruction without understanding its intent: - Instructors need to fully explain the instructional intent (course objectives) and its relationship to the knowledge, skills, and attitudes the students already possess. - Instructor must understand how current and prior knowledge determines what the students will learn from new material that conflicts with their existing beliefs. - Students should be asked to reveal their misconceptions so that the instructor can address them.

	Classroom Leadership
Important finding	Effective instructor classroom leadership promotes effective student learning.
Instructor leadership	Instructors lead students to learn by focusing on the following: - Presenting well-conceived learning objectives. - Conducting regular and comprehensive evaluations of student learning. - Having high expectations of all students. - Providing a purposeful learning environment. - Concerning themselves with student performance.
Diversity of opinion	Instructors should encourage diversity of opinion by: - Pointing out relationships between various opinions and ideas. - Stressing the variety of potential solutions to a problem. - Protecting minority opinions. - Keeping disagreement under control.
Peer feedback	Peer-feedback improves instructional effectiveness. Instructors can observe each others' classroom procedures and provide constructive feedback.
Objective grades	Students' grades should be based on objective attainment. Grades should not be used to correct disciplinary problems. Disciplinary problems are reduced when students actively participate in learning.
Instructor's role	Instructors must accomplish the following: - Help students perceive education and training as relevant and interesting. - Use techniques to reinforce good behavior. - Seek friendly relationships. - Encourage students to cooperate with other students and staff.

	Learning Strategies
Important finding	Study skills and strategies can influence what and how students learn. Students can learn effective study strategies.
Learning strategies	Study or learning strategies may affect learner motivation or the way they select, acquire, organize, or integrate new knowledge. An example of these strategies would be: - Learners may coach themselves to reduce anxiety. - Learners may use imaging to relate vocabulary words and meanings. - Learners may summarize and take notes to memorize written material.
Better students use learning strategies	Above average students use learning strategies to acquire, organize, or integrate new knowledge. Students may use imaging to relate vocabulary words and meanings, or summarize and take notes to memorize written material.
Average students infrequently use	Average and below average students use effective study strategies infrequently. They need to be taught how to use these strategies. Once they have learned the strategies, all students can study and learn more efficiently. They must be encouraged to do so.
Factors in student study	Students can monitor and adjust the way they study based on: - Whether they understand difficult material. - How much time they have for studying. - How much they know about the material. - The standards they must meet.

Continued on next page

Instructor role for improving study skills

Instructors' can help improve study skills by:

- Adjusting students' study methods according to content difficulty, time allowed for studying, familiarity with content, and standards required.
- Spreading study sessions on a topic over available time so students do not work continuously on a single topic.
- Using study strategies appropriate for learning a task.
- Use rehearsal and self-testing to memorize ordered lists, take notes that paraphrase a lecture, organize information in text by identifying main ideas and relating to current knowledge.
- Allowing students to assess their progress and modify the strategies as needed.

Effect of training

Training of techniques for learning from text materials has a substantial effect on test performance covering the content studied.

An example of training students to learn text

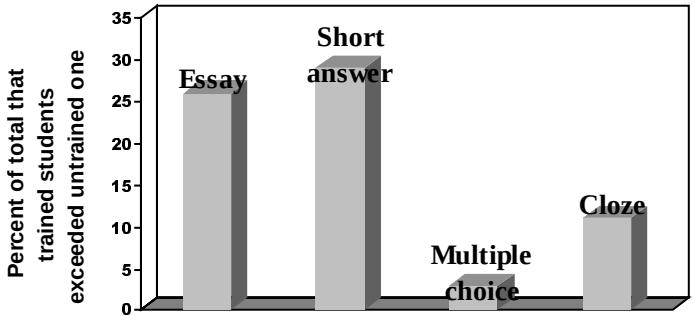
In the following example, students were taught:

- How to make a network map of the information in a text.
- How to make a spatial representation of the information.
- How to paraphrase.
- How to draw pictorial representations of ideas and concepts.

Four different measures were used to examine the effect of the training. Figure 3, taken from Montague and Knirk, shows that trained students substantially outperformed untrained ones on essay and short-answer tests. The histogram bars show how much the scores of the trained students exceeded those of untrained students.

On a "cloze" test every nth word in the material is deleted, and the student tries to fill in the correct word from memory. Trained students also showed superior performance on that type of test. On a multiple-choice test trained students' superiority was slight. This type of test is not as useful a test for examining student learning and understanding.

Figure 3. Effectiveness of Training Students to Learn from Text.



An example of training students to learn text (Continued)

Conclusion to Figure 3

Students given training in how to study text material outperform students not given training.

Testing Student Progress

Important finding	Frequent, systematic testing and assessing of student progress informs students about their learning. Instructors and managers learn about strengths and weaknesses in student learning and the instruction.
Types of tests	Students are tested to determine what they know and what they need to learn. Various types of tests can be used including observing laboratory exercise performance, giving oral quizzes and test, assigning homework, asking questions in the classroom, and giving comprehensive performance tests.
Advantages of student assessment	The following are advantages of student assessment: - Student errors on tests and in class alert instructors to learning problems that need to be corrected. - Student motivation and achievement improve when instructors provide prompt feedback on their performance and assignments. - Frequently tested students outperform less tested ones in the classroom.
Knowledge tests	Students generally take either knowledge or performance tests. Knowledge tests help instructors find out if the students have learned information important for safety and knowledge important for performance.
Performance tests	Performance tests enable instructors to determine student competence and identify student and instructor problems. The instructors' biggest concern with testing is to identify what the students do not know.

Continued on next page

Job-like tests	In technical training, assessment should be as job-like as possible. The following should be applied: - Emphasizing hands on performance tests. - Limiting pencil and paper tests to safety and knowledge, critical for job performance. - Testing with open-book where students use manuals and other references normally available on the job.
Performance difficulties	Performance difficulties often indicate gaps in student knowledge. Student explanations of their actions or answers to questions can help instructors identify knowledge gaps.

Providing Students Feedback

Important finding	Students who receive constructive feedback about the accuracy and adequacy of their performance become more interested in the class and learn more.
Immediate feedback	Giving immediate, constructive student feedback is an effective way for instructors to aid student learning.
Student feedback characteristics	No one method is best for providing student feedback. Feedback should have the following characteristics: - The feedback should be prompt and provide useful information. - Feedback emphasizing the method used to get the correct answer reinforces the solution.
Features of instructor feedback	Instructor feedback should have the following features: - Instructors should give nonspecific praise and criticism infrequently. It should be based on the quality of student performance. - Instructors should explain correct or incorrect performance. This is better than to give only the correct answer or to judge the student performance. - Instructors' feedback should routinely tell students when they are incorrect. They should focus on the content and explain how to reach the correct answer. - Instructors' critical feedback, written or spoken, should be given in private and not in front of the class.
Benefits of timely feedback	Constructive, timely feedback, helps students develop self-esteem as well as improve performance: - Students who believe they can succeed are usually more successful than those who are less sure of their ability. - Students who believe they can succeed are more active learners, work independently, cooperate with other students, and achieve more.

Managing Active Learning Time

Important finding	Students who are actively engaged in learning learn more than those passively involved.
Active involvement	The time allocated for learning differs from the time students are "actually engaged" in learning. This difference becomes important in hands-on training, whereby the lack of available equipment sometimes causes students to spend time observing others.
Passive exposure	Passive exposure to laboratory does not mean students are actively engaged in learning. Instructors should use techniques to engage all students in learning.
Effective instructors	Effective instructors determine learning time accurately and use techniques that increase the time students spend on learning activities. The following techniques are helpful: - Instructors minimize time for breaks and interruption of individual students. Students can help instructors analyze their classroom by identifying distracting events and procedures that could be changed. - Instructors can increase students' attention to learning and increase learning time and achievement. Questions can focus on material or problems in texts or manuals. - Instructors who summarize important information prepare students for studying. - Students who are easily distracted may profit from out-of-class assignments that focus on overcoming the distractions and processing relevant content. - Students who receive explicit feedback about their performance learn what is required of them and how to correct their actions.
Conclusion	Instructors who supplement a well-planned training program with these learning activities can achieve three major goals: - They can capture the students' attention. - They can make the best use of available learning time. - They can encourage academic achievement.

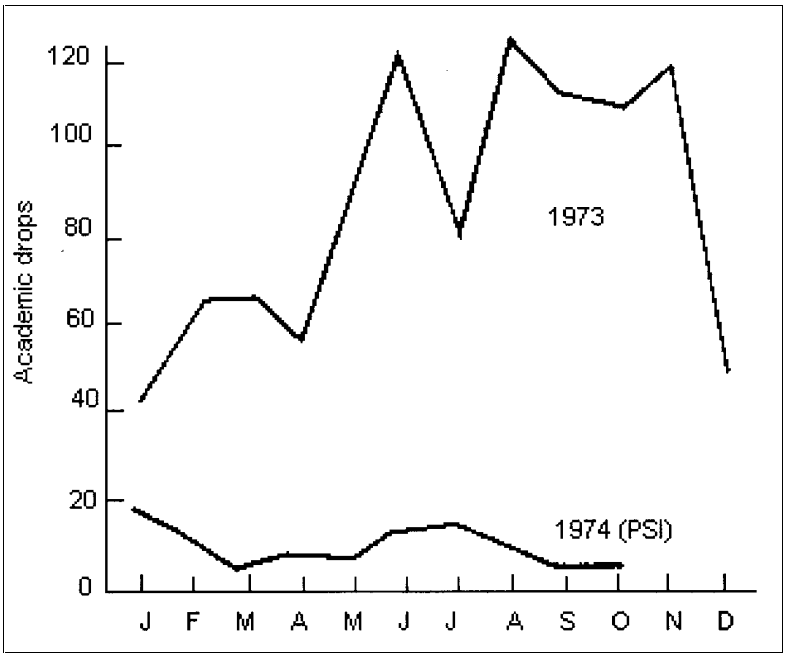
	Cooperative Learning
Important finding	Cooperating with other students during learning often improves learning.
Cooperative learning advantages	Some advantages of cooperative learning are: - Organizing students into small study groups improves performance on achievement tests. - Arranging students into small groups promotes positive attitudes toward each other and learning. - Organizing students into groups of two or three assist "team" activity and crew training for the Air Force.
Single student domination eliminated	It is important that one student does not limit opportunities for learning by dominating others. This can be achieved by testing them separately or by instituting other procedures that ensure that each student spends an appropriate amount of time actively learning.
Cooperation versus competition	Students tend to avoid activities that they believe will result in failure. A competitive situation arouses the need to either achieve success or avoid failure. Encouraging cooperation, rather than competition, among students promotes effective achievement and productivity.
Identifying poor performance	Instructors should demonstrate a cooperative spirit by not singling out poor performers. Self-esteem and ego are "on the line" when students are asked to perform in front of classmates. Bad experiences in traditional education, feelings about authority, and the preoccupation with events outside the classroom all affect experiences in class. Singling out poor performers leads to negative attitudes toward the instructor and the students.
Conclusion	Instructors can increase student learning by promoting cooperation rather than competition among the students. Students competing for grades or other extrinsic goals focus on beating other students rather than on understanding the course material and learning how to work as a team member.

Peer Teaching

Important finding	Students who receive instruction from peer teachers receive higher grades and develop positive attitudes toward training.
Advantages of peer instruction	Peer instruction provides the following advantages: - Peer interaction improves students' academic performances and attitudes. - Instructors can supplement regular classroom teaching with peer teaching. - Peer instruction helps slower students succeed. - Peer teachers benefit from preparing and giving lessons they prepare and present.
Peer teaching	Peer teaching can take a variety of forms as: - Instructor assistants leading discussion groups, seminars, or tutorial groups. - Senior students assisting new students (see the proctor model at Figure 4). - Student-led learning groups which have no instructors.
Raises test scores	Student coaching usually raises test scores (see Figure 4). The effects are greatest in long, cognitive and extensive drill-and-practice courses. Short test-taking oriented courses show the least improvement as a result of coaching methods.
Effectiveness of peer instruction	The graph at Figure 4, taken from Montague and Knirk (1993), is based on actual student performance. It demonstrates the relationship between peer teaching (student coaching) and reduction in student attrition.

Effectiveness of peer instruction (Continued)

Figure 3. Effectiveness of Peer Teaching.



Conclusion

Students bring a lot of invaluable life experiences into the classroom, which should be acknowledged and used. Students can learn much through interacting with respected peers.

Effective Instructor Presentations

Important finding	Students learn best when their instructors inspire them to take an active role in their learning.
Good instructors	Good instructors are not only subject matter experts in what they teach but know how to teach. They are prepared to answer student questions and stimulate student interaction.
Factors for effective presentations	For effective presentations, instructors should keep the following concepts in mind: - Present the material in a logical structure which can help students learn and remember. Students can remember only a small amount of material presented orally or visually. - Present no more than two or three main ideas in a 15-minute segment. - Use techniques to stimulate students to assume an active role in understanding what is taught. - Present summaries to reemphasize main ideas, illustrations, tables, and charts. - Use lesson enhancements that foster retention. Students are likely to remember the illustration used to teach a concept or practice.
Questioning atmosphere	Instructors who maintain a questioning atmosphere force students to think and solve problems.
Ways to stimulate learning	Instructors can use the following techniques to stimulate learning: - Ask students to summarize lessons. - Challenge students by providing incorrect information to determine if they can provide the correct information. - Divide students into small groups for discussions. - Ask questions randomly during lectures. - Relate directly to relevant "war stories" or anecdotes and explain their relevance clearly.

Continued on next page

Demonstrate task steps	Students learn best when instructors demonstrate steps to accomplish a task. Instructors should systematically demonstrate tasks, explaining the purpose and result of each activity. This is particularly effective in teaching basic skills, and in helping experienced students master complex materials.

Practicing Applications

Important finding	Practice promotes learning of new skills.
Lack of practice	Most education and training programs involve too much in the way of talking, presenting, and demonstrating on the part of the instructor.
Procedural tasks	With procedural tasks, listening and watching are not good enough if you have the option of doing. Remember that doing requires some initial level of learning.
Key points	The following key points contribute to successful practice: - Students learn best by doing and should have opportunities to practice. - Students should practice a variety of tasks representative of the job. - Instructors should emphasize key points to increase retention. - Explicit feedback helps students identify and correct performance difficulties.
Amount of practice	The amount of practice required to correctly perform a task usually increases with task complexity. In very complex tasks, small segments of a task should be practiced before the entire task. Removing a jet engine is a complex task, which might require practice on individual engine components (task activities) before the engine is actually removed.
Appropriate techniques	Using the wrong learning strategy inhibits learning during practice. Instructors should always use practice techniques appropriate for each task. In seemingly simple tasks such as memorizing strings of digits, students can practice for hours without improving their performance unless a proper learning strategy is used. Grouping or coding schemes may be the best way to learn strings of digits.

	Mental Models
Important finding	Mental models promote understanding of concepts.
Mental model definition	Learning involves the development of qualitative conceptual structures that are called "mental models." A person uses mental models to understand, explain, and predict things about the world. Mental models allow people to describe a system's structure, explain its present state, and make predictions about future states.
Mental models evolve	Mental models evolve naturally through the interaction of the learner and particular environments. Methods can be devised to promote their development as follows: - One way is representing the functionality of the work environment and the devices and equipment in it. Providing external guidance or directions allows the buildup of experience. This coupled with cognitive information will guide performance. - An accurate mental model develops from the way events flow on-the-job, and how devices function and can malfunction. This serves as the scheme to guide personal action when new problems are encountered. - Students should describe in detail the steps they are using in performing a task. This will help identify errors. Student competence develops faster and transfers readily to the work environment with this procedure.
Example	As an example, take the task of training the students to solve problems in electric circuits, thermodynamics, or mechanics. By guiding students through the steps, explaining why they are taken, and then having students describe the factors and their interactions as they solve subsequent problems, they learn rapidly and accurately. Instructors can check the accuracy of a student's initial representation of all facets of the problem and provide basic correct solutions.
Conclusion	By concentrating on accurate initial description of the problem, students learn to internalize the procedures as part of their mental model, which they use habitually in approaching problems later on.

Motivating Students

Important finding	Learning improves when students set their own goals and determine how to achieve them.
Student controlled learning	Students who believe they control their own learning experience, believe they can handle most training challenges. However, not all students can take charge of their own learning without encouragement and help.
Student set goals	Students can learn to set daily goals, monitor progress toward these goals, and chart progress to provide reinforcement. Instructors should always check students' progress and provide positive verbal encouragement and reinforcement.
Focus on competence	Extrinsic rewards (grades, etc.) may not motivate students as much as goals and rewards based on direct involvement with the ongoing education and training. Instructors should focus attention on the long term competence rather than extrinsic rewards. The following techniques are useful in promoting this focus: - Provide feedback that informs. - Encourage persistence in learning. - Point out instructional relevance.
Rewarding learning effort	Instructors frequently reward learner effort so that the learners may concentrate on working hard and fast rather than on the quality of their work.

Continued on next page

Instructors should emphasize

Instructors should examine their reward system and place more emphasis on the following to encourage effort and performance:

- Instructors should explain, when effort is rewarded, the extent to which the reward is for their effort, so that students do not confuse an effort award for quality performance.
- Students generally consider the quality of their work more when performance is emphasized.
- Instructors should never tell students who are failing that the failure is only because of lack of ability. Students who feel they do not have the ability to learn may develop a pattern of hopelessness and stop trying.
- Instructors should help students overcome training obstacles and devote effort to learning if there is any chance the individuals can succeed.

Conclusion

Instructors should focus on motivating their students, and on relevant learning tasks. Less capable students should be rewarded for progress; high achievers should always be challenged according to their abilities.

Student Controlled Learning

Important finding	Students' perceptions of who controls key events in learning significantly affects their academic achievement.
Student perceptions	Students generally attribute learning success to a combination of ability, effort, and luck. Students believe if they significantly control learning, they can also organize their environment for maximum success; that is they can "make their own luck."
Student perceptions of success	The following points represent student perceptions about success and failure: - Civilian schools have repeatedly demonstrated that in teaching slower students, the students think that other individuals cause their successes and failures. - Successful students are more likely to recognize their responsibility for achievement. - Students' perceptions about who caused their successes and failures depend on situational factors. Certainly instructors can change these perceptions. - Feedback on performance quality and how to improve it can teach slower students to recognize that they are responsible for their learning and performance.

Out-of-Class Assignments

Important finding	Students' performances improve significantly when instructors regularly give out-of-class assignments, ensure they are completed, and provide explicit feedback.
Students learn more	Students in courses requiring out-of-class assignments learn more than students in courses without such assignments.
Relevant out-of-class assignments	The time students spend on relevant out-of-class assignments benefits them as much as in-class learning time. Instructors should always grade assignments to inform students of their performance.
Benefits from out-of-class assignments	The following are benefits from out-of-class assignments: - Instructors can use out-of-class assignments to increase practice, a technique especially helpful for low achievers. - Low achievers doing out-of-class assignments often obtain grades as high as students do with greater ability that do not do extra assignments. - Out-of-class assignments boost student achievement through increasing total study time. - Out-of-class assignments can be helpful for all students, but especially for slower students.
Summary	Students are more willing to do assignments they consider useful. Instructors should give the same care in preparing out-of-class assignments as classroom instruction.
Conclusion	Out-of-class assignments must be an integral part of instruction. Evaluate them, and count them as part of the course requirements.

Conclusion to Techniques for Instructors

Excellent techniques are ageless

After looking at what civilian and military research found in the role of the instructor, one can see that some excellent techniques are ageless. We have to remind ourselves that what worked in the past can still work today.

What motivated instructors do

We learned in this section that a motivated instructor would help the student in the following ways:

Theoretical

- Bring good practices to bear on education and training.
- Focus classroom activities on learning.
- Emphasize student learning and achievement.
- Provide well-structured presentations and classroom activities.
- Arrange many and varied learning activities.
- Test and question students to evaluate their learning progress and maintain motivation to learn.

Hands On

- Monitor students studying and adjust their activities to maximize their effort and progress.
- Give corrective feedback regularly.
- Promote effective use of instructional time. Learn and use teaching techniques that enhance student learning.
- Create a job-like instructional situation.
- Emphasize hands-on, job-like performance tests.
- Provide students with opportunities for individualized work.
- Design out-of-class assignments to increase student achievement.

Caring about students

Most of all, right up front, you must care about your students and let them know you are excited about teaching them. If the students aren't convinced you care, all areas of discussion so far will not matter!

Manager, instructor, specialist are required

The manager and instructor are clearly important elements to ensure the student learns what is important, and the student feels good about what is learned. The specialist is the third element needed for the successful delivery of education and training.

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Specialist role

Specialists provide advice and assistance to managers and instructors. They assist with evaluation, course materials design and development. The instructor and specialist may be the same person. Economic realities make this an increasing probability. The next section will focus on what research contributes to the performance of the specialist.

Section C
Techniques for Instructional Specialists

Where to read about it

The following topical index is provided as a quick reference to this section.

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Systematic Instructional Design

Important finding	Systematic training design models provide methodologies for planning, analyzing, designing, developing, implementing, and managing instruction and are important for limiting content to what is clearly needed.
System approach similarities	System approaches to instructional design all require the same general steps or phases necessary to produce instruction to support the intended learning by students.
Positive characteristics of system approaches	System approaches share these positive characteristics: - These system models (refer to AFMAN 36-2234) make sure that every piece of instruction has recognizable elements and is tied to an analysis of needs and tasks to be learned. - They assist the management of training development by: making education and training congruent with job-tasks without irrelevant content, evaluating effectiveness and revising inadequate materials, making media development more efficient, promoting efficient use of time, and allowing for structured resource management and planning.
Limited training in systems approach	Quality of training programs applying systems approach models usually depends on the knowledge and skills of the personnel using the procedures. Most Air Force instructors receive only brief training in the use of these procedures.
Insufficient understanding	Insufficient understanding of how learning occurs prevents the development of simple, yet general and useful, theories of how to make it occur. Until this process is better understood, clear and simple prescriptions for devising instruction will not be available for them to follow.

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Air Force solution	The Air Force is currently attempting to fix this problem of insufficient understanding of how learning occurs by creating “How To” volumes on applying Instructional Systems Development (ISD) to Acquisition, Aircrew Training, Technical Training, Education, and Application to Unit Training (AFH 36-2235, Vols. 3, and 8 through 11).

Instructional materials must be tested	Because of the different levels of expertise involved in developing instruction, empirical tryouts of the instructional materials and system with students is very important.
Findings in this Volume Are Tested	Many of the research findings in this volume provide useful information for designing instruction. Developers need to become aware of these tried-out results and learn how to incorporate them into the instruction they design and develop.
Navy Instructional Quality Inventory	The Navy, as the Air Force, has developed a tool for reviewing objectives and checking their congruency with associated training and test items called the Instructional Quality Inventory (IQI). When applied to existing programs, or during the development of new courses, this IQI tool focuses instructional developers on the objectives and course requirements during the development of instructional materials and test items.

Instructional Objectives

Important finding	Objectives that directly reflect education/training requirements are easiest to test. Measurable, observable education/training objectives ensure consistency among job tasks, course content, and test items. When education/training include objectives, student confidence improves and anxiety decreases.
Objectives useful for all content	Objectives may be easier to write for concrete procedures rather than for more academic content areas such as history. There is no evidence to suggest that objectives are more useful for one content area than another.
Objectives have three elements	Expanding the task statements into objectives requires the following: - Clarifying the behaviors. - Identifying the relevant conditions under which the behaviors are to be displayed. - Specifying standards used to determine adequate performance. Test development is facilitated when objectives contain the above three elements.

	Text Enhancement
Important finding	Text enhancement through effective introduction, summaries, examples, and diagrams aids student comprehension.
Importance of text	Much education and training is accomplished through written descriptions. Texts are prepared to serve as a basis for student learning by providing facts, examples, and explanations.
Student understanding	To learn, students must understand the materials and how they can apply the information.
Reasons for lack of understanding	Descriptions, instructions, and explanations are often difficult to understand because of terminology, inadequate connections to student knowledge, or a "topic-orientation" that tells all about a subject, but not "what a person does" or "how to do it."
Performance oriented writing	Writing should be performance oriented rather than topic oriented. Topic oriented writing looks like reference material aimed at a general, unspecified audience, telling all about a subject and not how to apply the information.
Benefits of performance oriented writing	Performance oriented writing focuses on specific users; describes their roles, tasks, and responsibilities; and gives them the information they need about how to perform. The advantage of performance oriented text is that readers do not have to infer and conceptualize what to do; it is stated explicitly.

Writing techniques to improve student comprehension

Techniques for improving text comprehension include:

- Providing pre-presentation summaries outlining learning requirements.
- Inserting pictures showing spatial relationships, object form, or internal structures.
- Using concrete examples clarifying abstract ideas or depicting how principles work.
- Using methods that put demands on the student in reading and "processing" the text.
- Asking questions inserted before or after text segments to identify important information, or make desired inferences.
- Asking students to construct a diagram or "map" depicting the relationship of ideas in text to aid comprehension and remembering the information.

	Reading Grade Levels
Important finding	Reading grade level scores help in determining how well students understand instructional materials.
Readability predicts recall	Readability formulas predict how well personnel of varying reading ability can recall text they have read or heard.
Limitations of readability	Readability is of limited usefulness for predicting comprehension of instruction. It is limited because it does not: - Provide precise estimates of difficulty. - Estimate the difficulty of non-text materials such as tables and figures that make up much of the instruction in technical training courses. - Take into account how the materials will be used-- whether they are studied and learned or read while performing. - Take into account students' background knowledge in the area and related areas. Students with a lot of background knowledge can attain high comprehension while having reading ability several grade levels lower.
Issues other than readability	Issues other than readability should be considered in developing instruction. Performance oriented text is recommended in manuals over topic orientation. Topic oriented text tells the reader everything one wants to know about the topic, but it does not tell what actions are to be performed. A reader must infer what to do. Surprisingly, technical manuals and texts are often topic oriented. Performance-oriented text explicitly tells the reader what actions are expected.

	Building On Existing Knowledge
Important finding	Students learn best when instruction is adapted to existing knowledge, skills, and background.
Instruction should reflect student experience	Students can learn much from the invaluable life experiences they bring into the classroom. Education and training materials should consider students' existing knowledge and experiences.
Not critical to cover everything equally	It is not critical for educators and students to cover all topics and subjects equally well. Human energy and time are finite. Trying to master a little of everything may sacrifice efforts to focus on crucial information and issues.
Design instruction on entry behaviors	As instruction is being developed, education and training specialists should reference target population data to determine students' entry knowledge, skills, attitudes, and proficiencies so that instruction can be designed based on entry behaviors.

Using Examples

Important finding	Providing students with good representative examples and contrasting them with bad ones are effective instructional strategies.
Collect a variety of examples	It is necessary to collect a variety of examples that are not ambiguous or confusing.
Illustrate the task	Illustrate the task so that the student will understand the problem being studied and not acquire misconceptions.
Elements of a good example	Each example must be complete and self-contained. Each example should contain the necessary critical features or attributes so that the student can observe their presence or absence. The student should be able to construct adequate generalizations or representations of the tasks from a good example.
Good example characteristics	Good examples must possess the following characteristics: - The form and fidelity of each example must adequately represent the critical features of the task. - Examples should be as divergent as possible while belonging to the task being taught. This will prevent the formation of misconceptions. - Examples using extreme variations are avoided. They make examples difficult to understand or demand skills the students may not have. - Easier examples should be provided early in the lesson with a gradual increase in difficulty.
Attention focusing	Use attention-focusing devices to direct student attention to critical features, to confusing features, and to the absence of critical features. Students tend to respond to similar sets of stimuli in similar ways even when the response may be incorrect in one situation.

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Focus on critical differences	Exposing students to good examples paired with appropriate bad examples facilitates student discrimination. Focusing on the critical differences between good and bad examples, so they may be easily identified, will assist the student in better discrimination.

Conclusion	Just as students learn from their mistakes, they learn from good examples and bad examples.

Motivating Students

Important finding	When instruction gets the students' attention, students work hard, achieve more, and enjoy learning.
Four classes of factors influencing motivation	Four classes of factors influence student motivation to learn and determine their achievement. Including these factors in the design and development of instruction can have beneficial effects on student achievement.
Class 1: Exciting instruction	- Instruction that is attractive and exciting is especially useful to gain students' attention or interest. Instruction should include material that stimulates their curiosity and makes them eager to learn the material.
Class 2: Relevant instruction	- Students understand the relevance of instruction when objectives are explained to them and new learning is related to their past experience and knowledge. - Presentations need to explain the goals of the instruction, how the knowledge is to be used, and the role students will play in the work assignment when training is finished.
Class 3: Progressive sequencing	- Providing instruction that allows students to proceed through a sequence of graded steps maximizes the likelihood of learning and develops confidence in their ability to succeed. - Assisting students to solve learning problems early, students tend to reduce effort expended in learning when failure is repeatedly experienced. - Presenting simpler materials and problems first, arranging objectives in a progressive and logical sequence, and applying other techniques that facilitate making correct actions or explain adequate behavior--these all motivate behavior.

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Class 4: Adequate feedback	- Praise for accurate performance and informative feedback work better than threats or negative comments. - Feedback given soon after performance should emphasize what are the acceptable aspects of performance. - Information correcting errors or guiding performance may be most useful given just before another opportunity to perform.

Designing Effective Illustrations

Important finding	Diagrams, graphs, photographs, and illustrations improve student learning.
Benefits of utilizing illustrations	The following benefits from utilizing illustrations are: - Illustrations enhance instructional text and help students remember content. - Color illustrations encourage students to closely examine materials; color should be used especially to cue what is being learned.
Good illustrations	Good illustrations should have the following characteristics: - Illustrations should be as simple as possible to reduce confusion. - Illustrations should be directly related to the lessons. Those which are not are often more distracting than helpful. - Illustrations with highlighted or labeled information aids learning by making critical items more apparent. - Illustrations to show various switches on a complex system are a way of avoiding clutter.
Animation	Animation, which is the use of several visuals in rapid succession to simulate motion, may increase student attention. This technique is useful when the content is not appealing.

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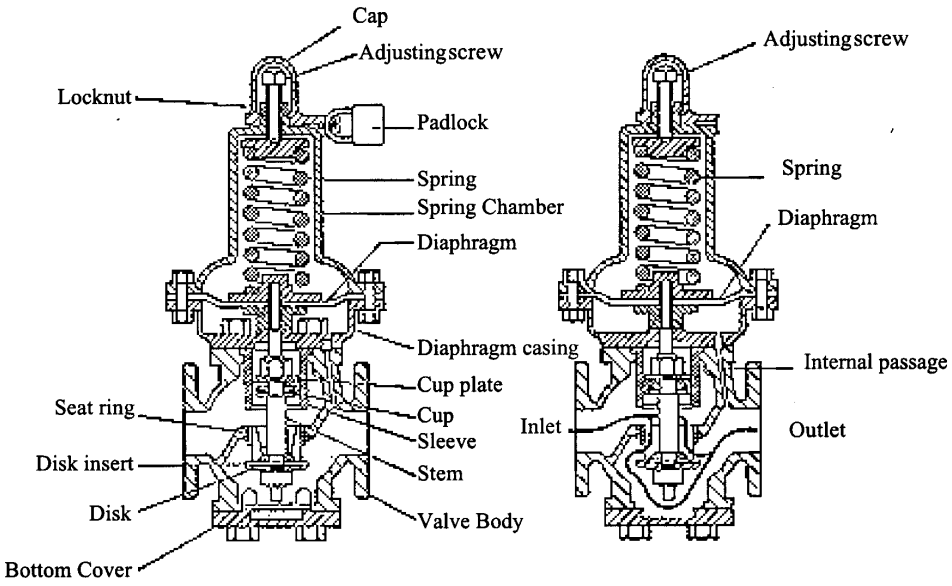
Example of contrasted illustrations

Two illustrations, taken from Montague and Knirk, are contrasted in Figure 5. The valve on the left is cluttered and confusing; it should be simpler and show only those parts necessary for instruction. Irrelevant labeling was removed from the valve on the right to show the most important parts.

Figure 4. Contrasted Illustrations.



Formative and Summative Evaluation

Important finding	Trying out instruction determines its overall effectiveness and efficiency.
Formative evaluation defined	Formative evaluation is performed while an instructional program is being developed. It identifies and removes the most obvious errors in the instruction, obtains initial reactions to the content from the students, and prevents compounding errors. The evidence collected is used to "form" the instructional program.
Questions answered in formative evaluation	Questions that should be asked during this type of evaluation should identify the students' perceptions of strengths and weaknesses of the instructional materials: - Is the instruction interesting? - Do the students understand what they are supposed to learn? - Are the materials directly related to the stated objectives? - How long do the students take to complete the material provided? Does this confirm planning? This type of student feedback can be extremely useful for the developer.
Summative evaluation defined	Summative evaluation, on the other hand, is usually undertaken when instructional development is complete using a larger sample of students. Its purpose is to provide "summed" evidence about how well an instructional program works.

	Effective Simulation
Important finding	Effective simulation provides systematic practice and feedback about errors, depicts how a device or system works but may violate physical and temporal fidelity.
Expensive simulators not always best	Expensive simulators, which are physically faithful to actual equipment, may not provide as effective training as simple, part-task trainers that simulate only a few features.
Complex simulators not for new students	Complex simulators may inhibit new students from keeping track of tasks, causing them not to see the results of their interactions with the system.
Simulators for new students	Simulators intended to train new students may need to be designed differently from those intended to train advanced students. New students need extensive, simplified guidance and precise corrective feedback while advanced students may only need to broaden their knowledge and skills.
Simulator advantages	Simulators offer many advantages in training: - They are often cheaper than actual equipment. - Dangerous critical tasks are best practiced using simulators. - The effectiveness of a simulation results from the instructional methods incorporated into the device that support student learning rather than from the simple physical or functional similarity to an actual device.
Design decisions	The design decisions are based on ways to isolate, or discriminate cues, and ways to provide time compressed practice for skill development rather than on particular hardware or media.
Analysis required	Needs and cost-effectiveness analyses must be performed before incorporating simulators into instructional programs.

	Effective Testing
Important finding	Testing needs to be geared closely to the goals of an education and training program.
Purpose of testing	Testing during and after instruction is used to indicate student progress, determine what students find difficult, and tailor individual assignments to overcome the difficulties.
Testing focused on performance	The testing should be focused on performance requirements which are derived from analysis of the work trained individuals are expected to do.
Means of testing	Various means of testing are used, including laboratory exercise performance, oral and written quizzes and tests, out of class assignments, classroom questions, and comprehensive performance tests.
Job related assessment	Assessment needs to be as job-like as possible. Performance tests should be hands-on. Pencil and paper tests of knowledge should be restricted to safety and knowledge critical for job performance. If workers use manuals and books to find the information needed to carry out a task on-the-job, open-book testing should be used.
Frequently tested students	Well-designed, performance oriented tests inform students about job requirements and guide their learning. Frequently tested students outperform less frequently tested ones.
Knowledge and performance tests	Students generally take two kinds of tests, knowledge and performance tests. - Knowledge tests help instructors find out if the students have learned information important for safety and knowledge important for performance. - Performance tests indicate student competence and provide information about both student and instruction inadequacies.

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Prompt testing and feedback	Errors that students make on tests and in class identify learning problems that need to be corrected. Instructors need this information to provide prompt feedback to students on their performance and assignments and to help correct any difficulties they may have.

Instructional Objectives and Tests	
Important finding	Objectives and tests must correlate with each other.
Derivation of objectives	Objectives are derived from the job performance and instructional requirements.
Composition of tests	Tests should be composed of the behaviors, conditions, and standards referenced in the objectives.
Performance and knowledge	Performance objectives and tests emphasize hands-on requirements while knowledge objectives and tests focus on information critical to job performance.

Instructional Time Distribution

Important finding	Spacing training over several sessions separated by other activities makes training more effective than masses of concentrated practice.
Students absorb	Students can absorb only a limited amount of information at one time.
Designing shorter distributive segments	Training can be made more effective by designing shorter, distributed lesson segments with periods of varied interspersed activities. Drill for certain skill enhancements can be made effective by using short sessions of one particular drill separated by other drill activities.
Distributive better than successive	Two distributed sessions are twice as effective as two successive sessions. Students' achievements following mass practices are not as high as achievements in shorter, distributed sessions.

Promoting Student Cooperation

Important finding	Promoting cooperation among students in training facilitates academic achievement.
Advantages of promoting student cooperation	Some advantages of promoting student cooperation are: - It is more effective than promoting interpersonal competition and individual effort to outshine others in class. - It may also assist subsequent team activities as students learn to work together. - It promotes positive feelings of personal worth and positive attitudes toward the course content.
Peer instruction	Arranging peer interaction in small groups to supplement regular classroom and laboratory teaching helps slower and underachieving students to learn and succeed in school.
Forms of peer cooperation	Peer cooperation can take a variety of forms: - Discussion groups, seminars, or tutorial groups led by teaching assistants. - The proctor model, where senior students may assist individual students. - Student learning groups that do not have an instructor or are self-directed, or senior students teaching entering students.
Benefits of student coaching	Student coaching is useful in raising achievement in the following ways: - The coaches benefit because they learn more about the material by preparing and giving lessons to others. - The effort of coaching usually raises achievement test scores. - The effects are greatest in long cognitive courses and extensive drill-in-practice courses. - Short courses that stress test-taking show the least improvement from coaching methods. - Classes that use tests at the start of the course report stronger coaching effects than classes giving tests only at the end.

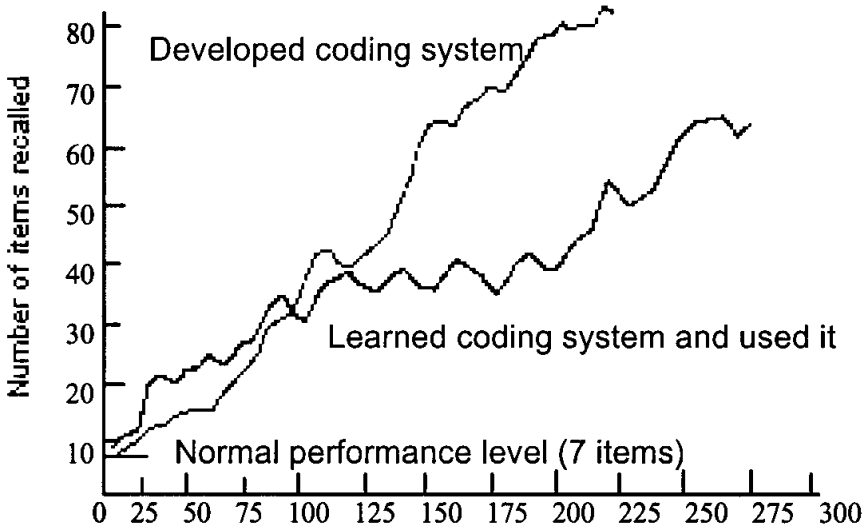
Continued on next page

Utilizing life experiences	Students bring many life experiences into the classroom, which should be acknowledged, tapped and used. They can learn well and much through cooperative study with respected peers.

	Memory Aids
Important finding	Mnemonic devices or coding systems help students recall important information.
Minimize memory requirements	The most important point to remember in memory learning, especially in the military, is that we need to minimize requirements to memorize. We need to do more to help students test application of knowledge early on.
Rote memory inefficient	When faced with memory activities, learning by rote seems an inefficient way of remembering.
Mnemonic devices help	When students are faced with a task requiring memory, they often try to devise a scheme to learn the task easier. Teaching students mnemonic procedures aids learning.
Recall can be improved	Individuals can recall short-term a string of seven unrelated items like digits or letters presented to them one at a time. Recall performance can be improved to many times beyond this seventh level by using a learning strategy like coding items into more meaningful chunks, and by practicing a lot. The Figure 6 shows data obtained from two persons who learned a way to increase memory-span to exceptional performance levels (Ericsson & Chase, 1982). The lighter line represents a person who was read strings of digits and was asked to recall them. He was a runner. Some digit groups reminded him of running times. He coded 3- and 4-digit groups as running times (e.g., 3492 was coded as 3 minutes 49.2 seconds). He constructed other mnemonic associations such as ages and dates. The darker line represents a person who was taught the memorization scheme. He was also a runner.

Recall can be improved (Continued)

Figure 5. Effectiveness of Cuing.



Conclusion to figure 6

Both runners in figure 6 performed exceptionally. The important point is that coding schemes based on a person's existing knowledge can serve as learning strategies. Good ones can be useful to all learners.

Self-generated schemes

Self-generated schemes are powerful tools in learning.

Extensive practice

Extensive practice is necessary to develop skill.

Many memory aids

There are many kinds of memory aids. Some formal devices composed of visual images or rhymes provide students mental cuing structures. Students learn the cuing structures first and associate each item of new information with one or more of the memorized cuing structures.

Continued on next page

Cuing structure

Usually, the cuing structure is not conceptually related to the information it cues. Consider the rhyming peg-word mnemonic system, "One is a bun, two is a shoe, three is a tree, etc." Students first memorize the ordered rhymes. Then, when they must learn an arbitrary set of items in order, they relate the first with "bun", the second with "shoe," and so on. Instructions often suggest using visualization to help relate the items.

Conclusion	Mnemonic devices are effective in helping students recall unorganized names and procedural data.

Conclusion to Techniques for Education/Training Specialists

Similarities between instructor and specialist

After looking at the instructional specialist we can see that some areas seem the same as the instructor's concerns which proves that in some environments the instructor is also the specialist.

We should look at the specialist both as a separate and interrelated instructional function depending on the environment.

Expectations for specialists

By looking at the section as a separate function the instructional specialist now can:

Theoretical

- Become assertive instructional leaders by emphasizing factors that bring about excellence.
- Learn and understand scientific bases from education and training excellence.
- Expect high quality and productivity from staff, instructors, and students.
- Promote interaction among instructors.
- Protect instruction from irrelevant demands.
- Adjust training to goals and to students through detailed evaluation of performance.
- Monitor development and empirical evaluation of training technologies.

Hands On

- Implement and monitor in-service staff training.
- Monitor and evaluate instructors and instruction.
- Develop well-structured, work-like education and training environment to support student learning.
- Assist instructors in providing feedback to students.
- Analyze and propose improvements in education and training effectiveness and efficiency.
- Provide input to higher management regarding education and training policy.

Section D
Physical Classroom Environment

Important finding	Classroom lighting, color, temperature, humidity, and noise levels affect student perception, attention, and achievement.
Properly designed	A greater level of learning occurs in a well-designed learning environment than in a poorly designed one.
Winter room climate	A temperature range of 68-74 degrees F at 30 inches from the floor in the winter is healthful and comfortable. The humidity should be kept between 30-60%.
Sedentary and active tasks	The maximum temperature for adult learners for sedentary tasks is 85 degrees F and 65 degrees F for active tasks.
Noise	Background noise apparently interferes with learning or concentration in some learners more than others.
Highest acceptable noise level	The highest level of background noise in a learning environment should not exceed 45 dB.
Optimum noise level	Optimum noise level is 30 dB for a learning environment.
Noise limits	Noise levels above 96db seriously impact student error rates. Noise effects of continuous and intermittent pure tone, and noise at fairly low levels of 70dbA, results in a significant decrease of learner performance where high cognitive loading tasks are required.

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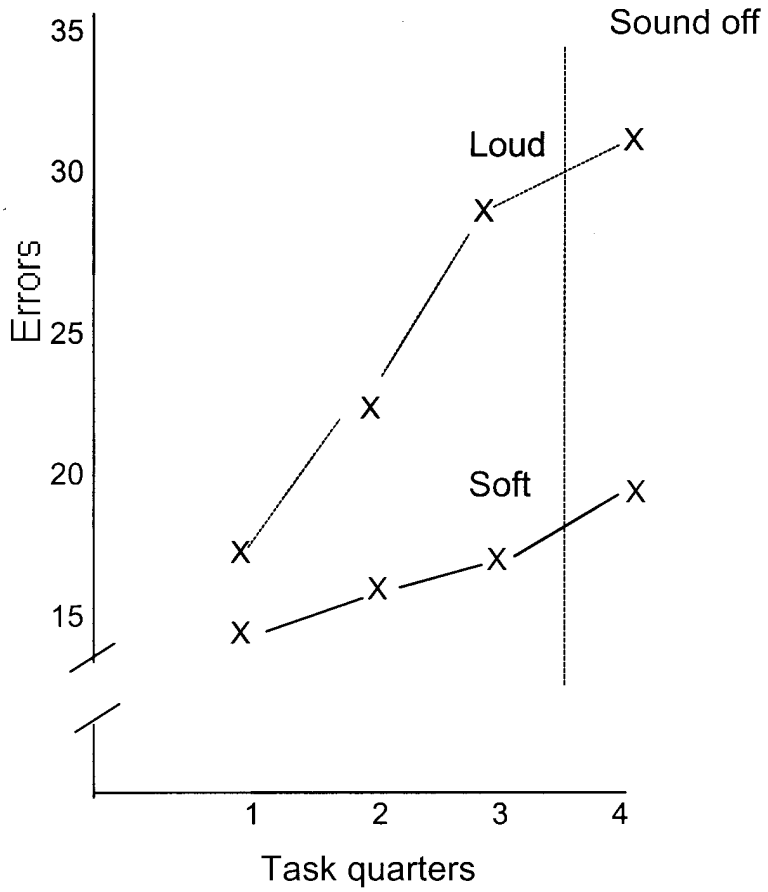
Graphic example of noise effects

Many experiments were conducted studying the effects of noise on sustained attention. The Figure 7 below illustrates the effects of noise on the incidence or errors over time in a serial reaction task lasting 40 min. Precautions to eliminate the effects of acoustic cues were taken, which included the use of a silent keyboard and ear defender headphones. In both loud (90dbC and soft 60dbC) conditions the noise is switched off at the end of the third quarter.

Figure 6. Effects of Noise on Student Error.



Lighting Importance

Light levels should be directly related to the viewing difficulty of the learning tasks. Insufficient illumination, glare, reflectance, shadows, low brightness contrast, and flickering affect human performance. Good lighting and color decisions increase human performance.

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Lighting levels	Lighting for reading tasks should be at the lighting level of 540-755 lux. Lighting for bench work should be at the lighting level of 540-1000 lux. Lighting for learning rooms should be at the lighting level of 500-750 lux.
Avoid lighting extremes	Extreme light level contrast must be avoided. Constant adaptation of moving from a brightly lit to a darker area can cause eyestrain and headaches.
Biological effect of lighting	Lighting has a profound biological effect on humans. The quantity and quality of light are important. Natural, full spectrum tubes (as opposed to traditional fluorescent tubes), reduces individual stress and aggression, and yet is more intellectually stimulating.
Student preferences for lighting	While light level preferences differ among individuals, bright lighting increases achievement for most students. Students preferring low lighting did better under lower light conditions. A learning environment should not be uniformly bright and students should be allowed to sit where their light preferences direct them.
Windows?	Data neither consistently support claims that windowless classrooms will allow increased concentration and higher achievement, nor the fear that the absence of windows will have harmful psychological or physical effects.
Color importance	Color influences student learning, attitudes, and behavior. The impact of color on an individual changes with age and with cultural background. Color directly influences physiology as measured by blood pressure, respiratory rate and reaction time.
Color and time	Color has a direct relationship on an individual's sense of time. Red causes more people to overestimate time, while greens and blues in the environment cause an underestimation of time.
Bright colors	Bright colors (such as red) tend to increase an individuals activity level.

Choosing colors	Types of objectives to be taught in an area should be considered in choosing classroom or study area colors. Some general guidelines for choosing colors: - Classrooms or laboratories: greens, blue-greens, gray, beige. - Gyms: neutral tones or cool colors. - Auditoriums: green, aqua, peach. - Entry areas: pink (also useful in prison holding tanks to quiet prisoners), or neutral tones.
Changing colors	Changes in classroom colors can affect learners. Painting the classroom a light neutral color and using floodlights to change the setting can affect individual attitudes and change the focus area.

Chapter 3
AUTOMATED TOOLS

Overview

Introduction

One of the most frequent suggestions for improving instructional systems is automation. Management information systems that track courseware development have become necessary. This is especially true for producing training for large weapon systems.

Decision support tools

Decision support tools that assist with such tasks as designing instruction, selecting instructional strategies and media, are vital to expeditious development of training.

Automated tools for instructional development

This section identifies selected automated tools that facilitate Air Force instructional planning, design, development and delivery. A complete list of tools to assist you in developing a training program can be found in a "Survey of Training Development Software Tools" developed by the Computer-Aided Acquisition and Logistic Support (CALS) Human System Components Committee.

Where to read about it

This chapter contains two sections.

Section	Title	Page
A	Designer's Edge Pro (Allen Communications)	91
B	Designer's Edge Enterprise (Allen Communications)	94

Section A
Designer's Edge Pro (Allen Communications)

Date of software	April 1997
System requirements	The minimum system requirements are: - IBM-compatible PC - 486 SX processor - 8MB of RAM - 5MB extra disk space (after installation) - VGA-compatible graphics card - CD-ROM drive - Windows-compatible mouse - Microsoft Windows 95 The recommended system requirements are: - IBM-compatible PC - 486 DX2 processor - 16 MB of RAM - 5 MB extra disk space (after installation) - SVGA-compatible graphics card - CD-ROM drive - Windows-compatible mouse - Microsoft Windows 95.
Other required software	Other required software includes: - Word-processing package (i.e. Microsoft Word, WordPerfect, WordPro) - Authoring software (i.e. Quest, Authorware Pro, IconAuthor, CBT Express, Toolbook II, Visual Basic).
Purpose	Designer's Edge helps the training manager, training designer/developer, ICW designer/developer, instructor, and subject matter expert use the ISD process to design/develop a course from analysis through evaluation.

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Purpose (Continued) This system is made up of 12 phases (major ISD divisions) each having numerous tasks (ISD processes). Each phases is explained below:

Analyze Needs: Provides processes to assess how things are and how things should be as well as measuring the differences. This step includes tools to gather the necessary data, write and prioritize goals, and write a needs analysis report. This step allows the user to plan for altering the situation through training to eliminate the need.

Draft Mission Statement: Provides tools to describe, in general terms, what the training course should accomplish. This helps the user define the project size and scope.

Create Audience Profile: Gives the user the ability to understand the audience the course will be targeted towards. Background, age, interests, and the participants' reasons for taking the training are all-important elements to consider when developing a course.

Write Objectives: This Phase provides a wizard and tools to write objectives.

Analyze & Outline Content: Provides a road map for the course. This phase gives the user tools to gather and analyze content and build a course outline.

Layout Course Map: This phase helps the user determine how the course will be structured, what will be taught, lesson length, student evaluation methods, and overall layout of the course.

Define Treatment: This phase allows the user to focus on the audience setting the theme, tone, pacing of the course.

Select Learner Activities: Helps the user determine the best strategies for the audience, apply activities to course sections, sequence activities to enhance the learning process, and develop an authoring prototype.

Create Detailed Plan: Gives the user the ability to create a storyboard (blueprint for the course).

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Purpose (Continued)	Produce Media: Helps the user organize all the media elements required for a course. Various reports can be made and organized for production recommendations, graphics created, locate existing video, create a media log, and produce manuals/documents. Author Course: This phase enhances the development efforts before the authoring phase. It can be used with many of the authoring systems of today (Quest, Toolbook, IconAuthor, etc…). This phase also takes the storyboard into an authoring system. Evaluate Course: Gives the user tools to do both the alpha and beta tests before course implementation.
Other features	Designer's Edge comes with a customizer and wizard editor. Using the customizer, the designer can lay out or restructure the phases and tasks to meet their organization's work methods by adding/removing phases and tasks. The wizard editor gives the user the capability to create their own wizards or modify the wizards that come with the software.
Point of contact	HQ AETC/XPRI, Randolph AFB TX 78150-4321, DSN 487-8035 or Commercial 210-652-8035.

Section B
Designer's Edge Enterprise (Allen Communications)

Date of software	November 1999
System requirements	Minimum system requirements are: - IBM-compatible PC - 486 SX processor - 8MB of RAM - 5MB extra disk space (after installation) - VGA-compatible graphics card - CD-ROM drive - Windows-compatible mouse - Microsoft Windows 95 Recommended system requirements are: - IBM-compatible PC - 486 DX2 processor - 16 MB of RAM - 5 MB extra disk space (after installation) - SVGA-compatible graphics card - CD-ROM drive - Windows-compatible mouse - Microsoft Windows 95
Other required software	Other required software includes: - A word-processing package (i.e. Microsoft Word, WordPerfect, WordPro) - Authoring software (i.e. Quest, Authorware Pro, IconAuthor, CBT Express, Toolbook II, Visual Basic)

Purpose	Like Designer's Edge Pro, Designer's Edge Enterprise helps the training manager, training designer/developer, ICW designer / developer, instructor, and subject matter expert use the ISD process to design and develop a course from analysis through evaluation. The enterprise version can be used on a single workstation (similar to Designer's Edge Pro) and can also be used over a Local Area Network (LAN) system. In the LAN configuration, database connectivity is provided via Open Database Connectivity (ODBC) between the Designer's Edge application running on the client's personal computer and the database running on the server. Designer's Edge Enterprise can use the following database programs: Access 97, Oracle 7 or 8, Microsoft SQL Server 6.5 or 7, Sybase II, and Sybase SQL Anywhere 6.0. Other added features of Designer's Edge Enterprise are an authoring synergy with Microsoft PowerPoint and the ability to take the course storyboard and convert it into an HTML format.
Point of contact	HQ AETC/XPRI, Randolph AFB TX 78150-4321, DSN 487-8035 or Commercial 210-652-8035.

Section C
Instructional Systems Development Automation (ISDA)

Date of software	April 1992.
System requirements	80286 CPU, 512 Kb RAM, MS DOS, 2.0 or higher, hard disk (required disk space depends on the size of the data files).
Purpose	ISDA assists in the instructional design and development processes.
Description	ISDA addresses the problem of labor intensiveness by eliminating repetitive data input, filtering out non-training requirements early in the analysis process, and automating report generation.
Input data	The analyst input data from any source, i.e., Logistic Support Analyses (LSA), technical manuals, etc. This information is broken down into sequential activities and analyzed. The software uses embedded decision logic to pull forward only those activities that require further analysis.
System generated reports	The system generates a variety of reports, from task and duty lists to hardware and Computer Based Training (CBT) fidelity analysis documentation. These reports consume a considerable amount of consolidation effort under the paper analysis methodology.
Embedded decision logic	ISDA addresses the problem of a lack of standardized analysis parameter application by using embedded decision logic to assist the analyst in making training decisions.
System prompts questions	The system prompts the analyst with questions at the task activity, knowledge and skilled behavior, media, hardware, and CBT fidelity analysis levels. The analyst's answers to these questions provide the relevant information that the system uses to baseline decisions.

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602nd TSS Automated ISD Process

ISDA software is designed to automate the 602nd TSS ISD process through Step 9, "Select Instructional Features." ISDA generated reports are included in the training equipment functional specifications. The ISDA reports form the basis for course control documents.

Decision logic

The decision logic used in ISDA was also incorporated into the Joint Service ISD Logistics Support Analysis Record Decision Support System (JSISD/LSAR DSS) referenced earlier in this section. This is a project sponsored by the Armstrong Laboratory aimed at automating the LSA data flow into the ISD process.

Detachment 1, AETC Studies and Analysis Squadron (SAS)

A significant part of the Det 1, AETC SAS's mission is to determine maintenance training requirements for new/highly modified weapon systems. The detachment's ISD model based on an updated Air Force ISD model outlined in AFMAN 36-2234, Instructional System Development, aligned it with the Analyze and Design phases, and further organized it into a six phase, 15 step process.

Phase	Step	Description
Phase I – Gather data	1	Identify system requirements.
	2	Identify desired training outcomes.
	3	Identify target population characteristics.
	4	Identify training inadequacies.
	5	Assess technology.
Phase II – Analyze tasks	6	Identify tasks and subtasks for training.
	7	Identify behaviors, prerequisites, and environmental objects.
	8	Identify media.
Phase III – Assess training	9	Assess existing training

Continued on next page

Detachment 1, AETC Studies and Analysis Squadron (SAS) (Continued)

Phase	Step	Description
Phase IV – Identify trainers	10	Identify fidelity levels.
	11	Identify training devices and learning systems.
	12	Prepare functional specifications.
Phase V – Reconcile shortfalls	13	Prepare objectives.
	14	Identify specific media and methodology.
Phase VI – Prepare reports	15	Assemble information for final report.

Successful applications

Previous releases of the detachment ISD tool were used for maintenance training development/assessment on the Defense Satellite Communication System, Third Generation (DSCS III) and B-2 programs.

Point of contact

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DSN: 527-8812, Commercial: 805-277-8812.

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DCS/Personnel

Attachment 1
Air Force ISD Documents

AFPD 36-22	Military Training
AFI 36-2201	Developing, Managing and Conducting Military Training
AFI 36-2301	Professional Military Education
AFMAN 36-2234	Instructional System Development
AFMAN 36-2236	Handbook for Air Force Instructors
AFH 36-2235	Information for Designers of Instructional Systems (12 Volumes)
Vol 1	ISD Executive Summary for Commanders and Managers
Vol 2	ISD Automated Tools/What Works
Vol 3	Application to Acquisition
Vol 4	Manager's Guide to New Education and Training Technologies
Vol 5	Advanced Distributed Learning: Instructional Technology and Distance Learning
Vol 6	Guide to Needs Assessment
Vol 7	Design Guide for Device-based Aircrew Training
Vol 8	Application to Aircrew Training
Vol 9	Application to Technical Training
Vol 10	Application to Education
Vol 11	Application to Unit Training
Vol 12	Test and Measurement Handbook

Attachment 2
Category Bibliography

Simulation-Based Training

Simulation based training takes two forms: the high-end, real-world simulators like flight simulators that are very expensive to design and build and the desk-top part task simulation that can supplement other forms of training. The following source is concerned with desk-top simulation rather than full scale simulators.

To learn to design simulation-based training consider the following

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Attachment 3
Abbreviations

AETC	Air Education and Training Command
AFH	Air Force Handbook
AFMAN	Air Force Manual
AIMS	Automated Instructional Media Selection Model
ATC	Air Training Command
CAI	Computer Aided Instruction
CALS	Computer Aided Acquisition and Logistic Support (CALS) Human System Components Committee
CBT	Computer Based Training
DIF	Difficulty, Importance and Frequency Model
ECA	Early Comparability Analysis Model
GAIDA	Guided Approach for an Instructional Design Advisor
GCASS	GTET Cost Analysis Support System
GMISS	GTET Management Information Support System
GTET	Guidelines for Transportable Education And Training System
ICW	Interactive Courseware
IQI	Instructional Quality Inventory
ISD	Instructional System Development
ISDA	Instructional System Development Automation
IVD	Interactive Video Disk Instruction
JS ISD/	Joint Service Instructional Systems Development
LSA	Logistic Support Analyses
LSAR DSS	Logistics Support Analysis Record Decision Support System
STAM	Sub Task Analysis Model
TAP	Test Analysis Package
TASCS	Training Analysis Support Computer System
TPDC	Training and Performance Data Center
TRACES	Training Cost Estimator System
TRANSFORM	Training System For Maintenance